ASW314

5 ~ 3000 MHz MMIC Amplifier

Features

- 16 dB Gain at 900 MHz
- 21 dBm P1dB at 900 MHz
- 44 dBm Output IP3 at 900 MHz
- 1.9 dB NF at 900 MHz
- MTTF > 100 Years
- Single Supply

Description

The ASW314, a power amplifier MMIC, has a high linearity, high gain, and high efficiency over a wide range of frequency, being suitable for use in both receiver and transmitter of telecommunication systems up to 3 GHz. The amplifier is available in a SOT89 package and passes through the stringent DC, RF, and reliability tests.

RoHS-compliant GREEN Package

Package Style: SOT89

Typical Performance

(Supply Voltage = +5 V, T_A = +25 °C, Z_0 = 50 Ω)

Parameters	Units	Typical				
Frequency	MHz	5	150	900	1950	2700
Gain	dB	13.7	16.2	16.0	14.5	14.5
S11	dB	-13	-13	-20	-13	-18
S22	dB	-12	-13	-15	-13	-11
Output IP3	dBm	40[1)]	41[1)]	44[2)]	43[2)]	38[3)]
Noise Figure	dB	2.9	1.7	1.9	3.0	3.1
Output P1dB	dBm	20.0	22.0	21.0	23.0	20.5
Current	mA	105	105	105	105	105
Device Voltage	V	+5	+5	+5	+5	+5

1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.
2) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.
3) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1 MHz.

Product Specifications

Parameters	Units	Min	Typ.	Max
Testing Frequency	MHz		900	
Gain	dB	15.0	16.0	
S11	dB		-20	
S22	dB		-15	
Output IP3	dBm	41	44	
Noise Figure	dB		1.9	2.2
Output P1dB	dBm	20	21	
Current	mA	85	105	125
Device Voltage	V		+5	

Absolute Maximum Ratings

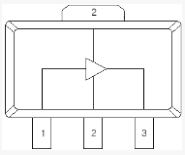
Parameters	Rating
Operating Case Temperature	-40 to +85 °C
Storage Temperature	-40 to +150 °C
Device Voltage	+6 V
Operating Junction Temperature	+150 °C
Input RF Power (CW, 50 Ω matched as in 900 MHz application circuit)*	+23 dBm
Thermal Resistance	60 °C/W

* Please find the max. input power data from http://www.asb.co.kr/pdf/Maximum_Input_Power_Analysis.pdf
The max. input power, in principle, depends upon the application frequency and the matching circuit.

Application Circuit

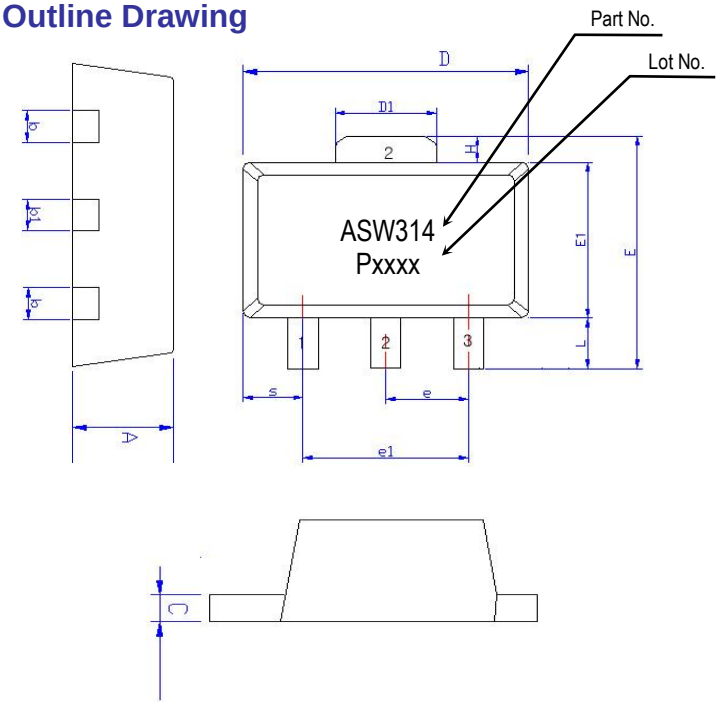
- IF (80 ~ 450 MHz)
- 170 ~ 794 MHz
- LTE (698 ~ 787 MHz)
- CMMB
- 900 MHz
- LTE (1745 ~ 1860 MHz)
- 1880 ~ 2025 MHz
- 1950 MHz
- 2300 ~ 2400 MHz
- 2400 MHz
- 2700 MHz
- 800 ~ 1500 MHz (MoCA, 50 Ω)
- 900 ~ 2200 MHz (SMATV, 50 Ω)
- 20 ~ 3000 MHz
- 500~ 3000 MHz
- 5 ~ 1000 MHz

Pin Configuration



Pin No.	Function
1	RF IN
2	GND
3	RF OUT & Bias

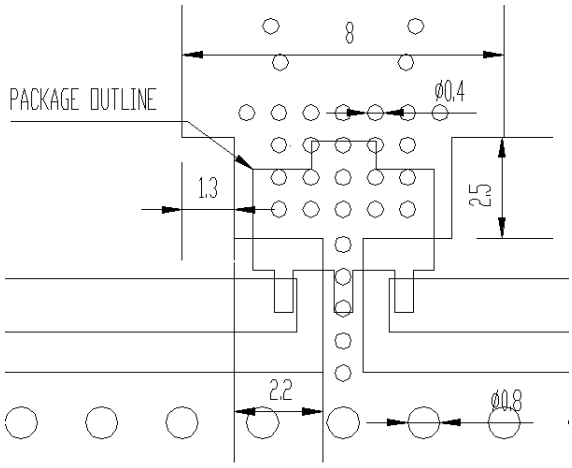
Outline Drawing



Symbols	Dimensions (In mm)		
	MIN	NOM	MAX
A	1.40	1.50	1.60
L	0.89	1.04	1.20
b	0.36	0.42	0.48
b1	0.41	0.47	0.53
C	0.38	0.40	0.43
D	4.40	4.50	4.60
D1	1.40	1.60	1.75
E	3.64	---	4.25
E1	2.40	2.50	2.60
e1	2.90	3.00	3.10
H	0.35	0.40	0.45
S	0.65	0.75	0.85
e	1.40	1.50	1.60

Pin No.	Function
1	RF IN
2	GND
3	RF OUT & Bias

Mounting Recommendation (In mm)



Note: 1. The number and size of ground via holes in a circuit board is critical for thermal and RF grounding considerations.
2. We recommend that the ground via holes be placed on the bottom of the lead pin 2 and exposed pad of the device for better RF and thermal performance, as shown in the drawing at the left side.

ESD Classification & Moisture Sensitivity Level

ESD Classification

HBM	Class 1A
	Voltage Level: 400 V
MM	Class A
	Voltage Level: 50 V

CAUTION: ESD-sensitive device!

Moisture Sensitivity Level (MSL)

Level 3 at 260 °C reflow

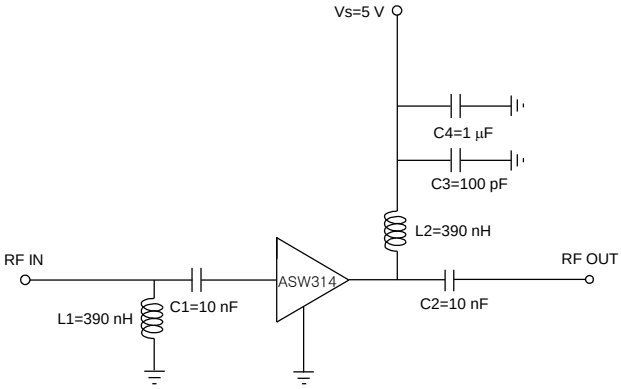
APPLICATION CIRCUIT

IF
80 ~ 450 MHz
+5 V

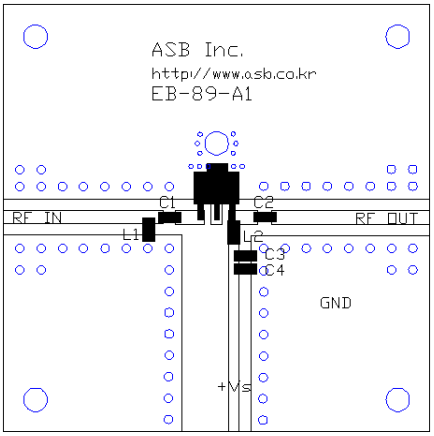
Frequency (MHz)	80	150	350	450
Magnitude S21 (dB)	16.7	16.2	16.0	15.9
Magnitude S11 (dB)	-12	-13	-12	-12
Magnitude S22 (dB)	-12	-13	-12	-12
Output P1dB (dBm)	22	22	22	22
Output IP3[1)] (dBm)	41	40	40	42
Noise Figure (dB)	1.7	1.7	1.9	2.0
Device Voltage (V)	+5	+5	+5	+5
Current (mA)	105	105	105	105

1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

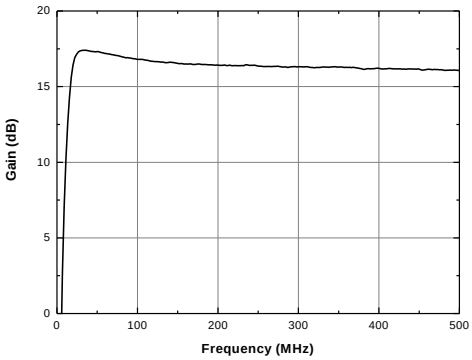
Schematic

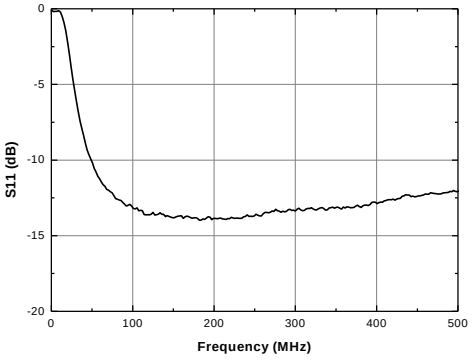


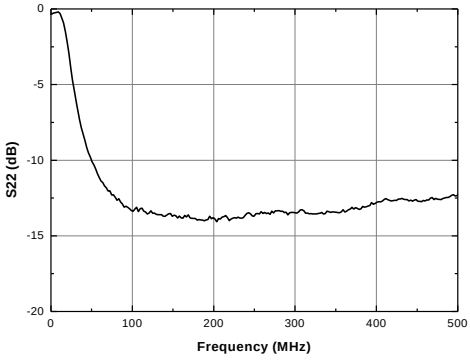
Board Layout (FR4, 40x40 mm², 0.8T)

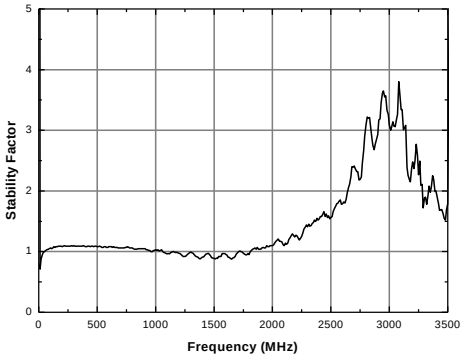


S-parameters & K-factor









APPLICATION CIRCUIT

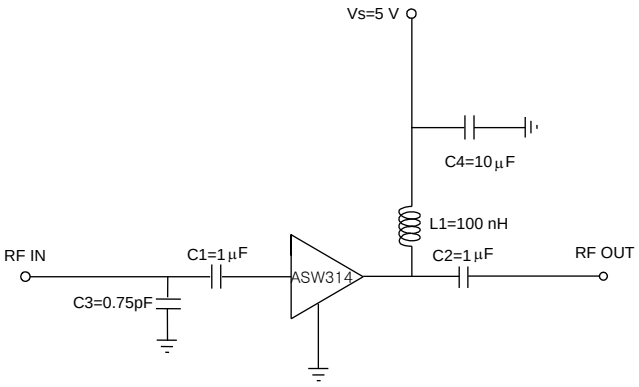
170 ~ 794 MHz

+5 V

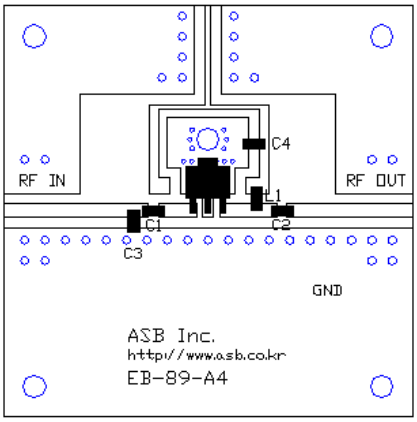
Frequency (MHz)	170	794
Magnitude S21 (dB)	16.1	15.8
Magnitude S11 (dB)	-9	-9
Magnitude S22 (dB)	-10	-10
Output P1dB (dBm)	21.5	21.5
Output IP3[1] (dBm)	42.5	41.5
Noise Figure (dB)	1.6	1.8
Device Voltage (V)	+5	+5
Current (mA)	105	105

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

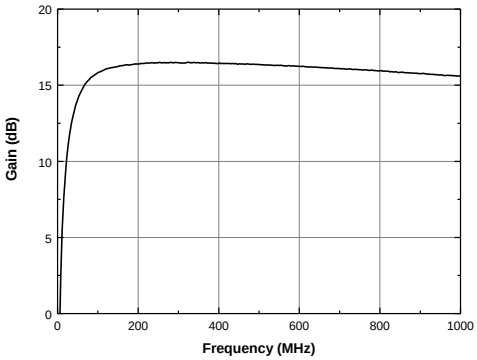
Schematic

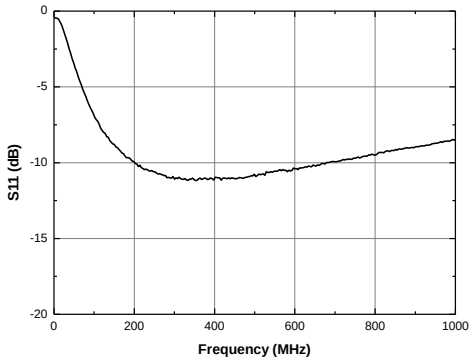


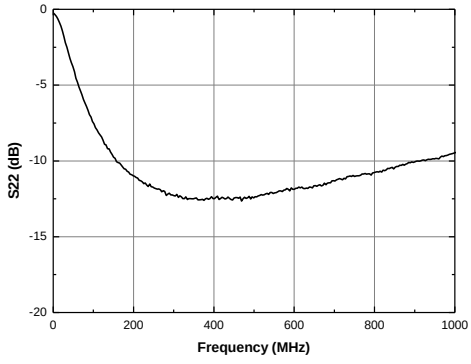
Board Layout (FR4, 40x40 mm², 0.8T)

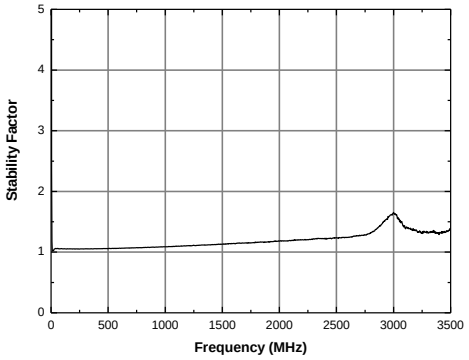


S-parameters & K-factor









APPLICATION CIRCUIT

LTE

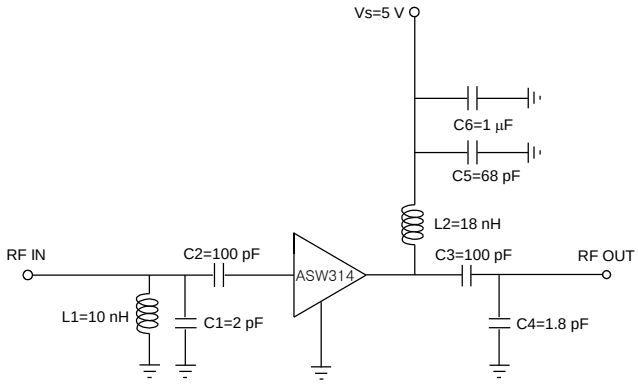
698 ~ 787 MHz

+5 V

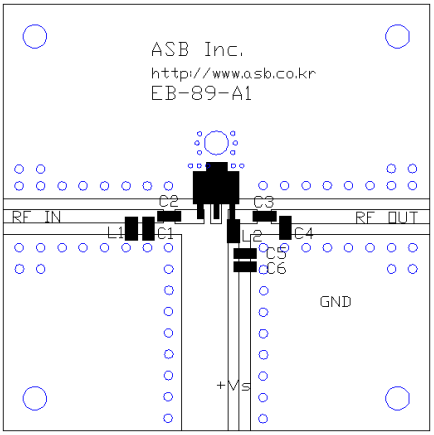
Frequency (MHz)	698 ~ 787
Magnitude S21 (dB)	16.0
Magnitude S11 (dB)	-15
Magnitude S22 (dB)	-18
Output P1dB (dBm)	21.5
Output IP3[1)] (dBm)	43.5
Noise Figure (dB)	2.0
Device Voltage (V)	+5
Current (mA)	105

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

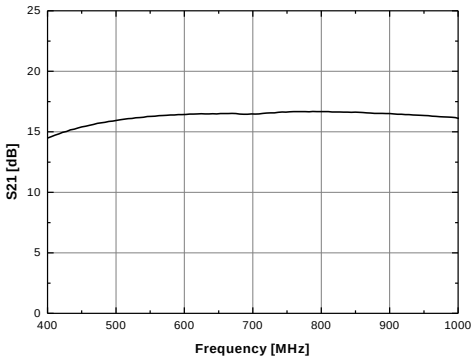
Schematic

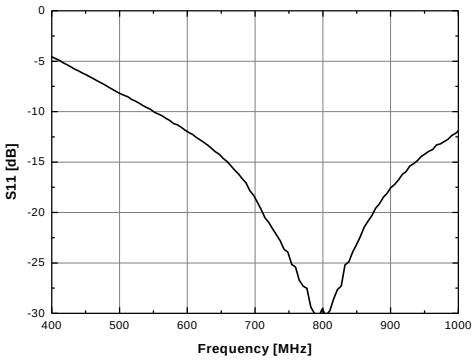


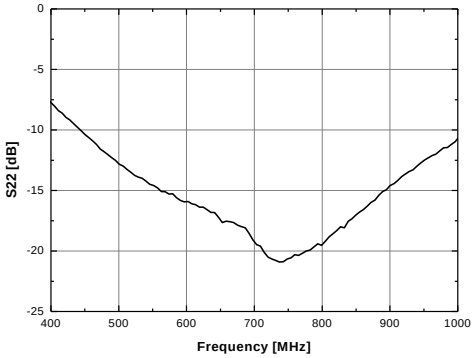
Board Layout (FR4, 40x40 mm², 0.8T)

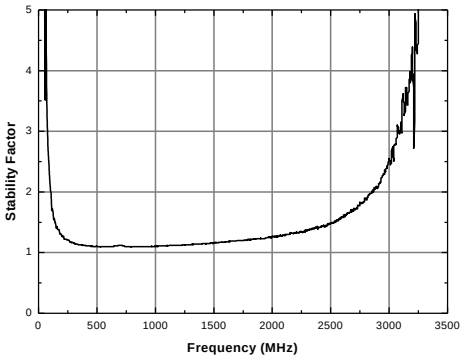


S-parameters & K-factor









APPLICATION CIRCUIT

CMMB

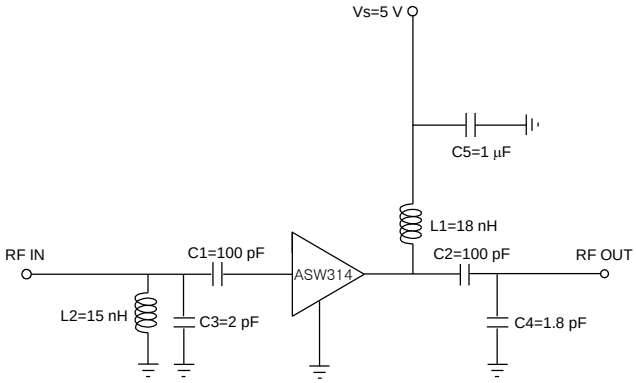
470 ~ 860 MHz

+5 V

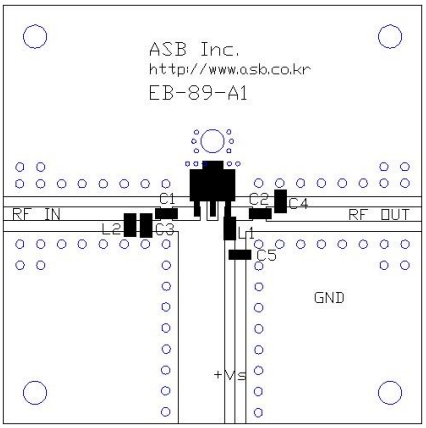
Frequency (MHz)	470	860
Magnitude S21 (dB)	16.0	16.0
Magnitude S11 (dB)	-12	-11
Magnitude S22 (dB)	-13	-11
Output P1dB (dBm)	22.0	21.5
Output IP3[1] (dBm)	42.5	43.0
Noise Figure (dB)	2.2	1.8
Device Voltage (V)	+5	+5
Current (mA)	105	105

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

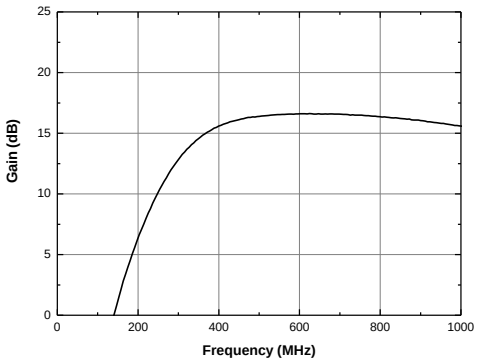
Schematic

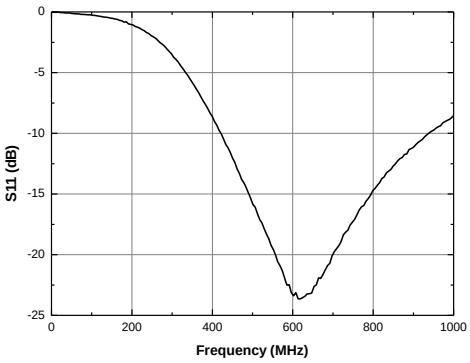


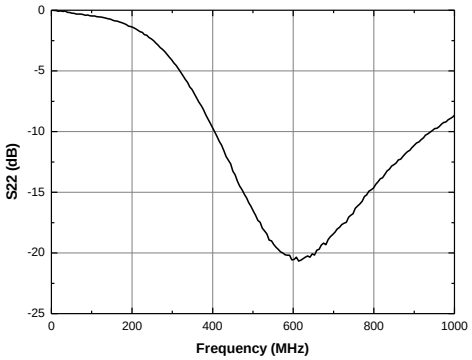
Board Layout (FR4, 40x40 mm², 0.8T)

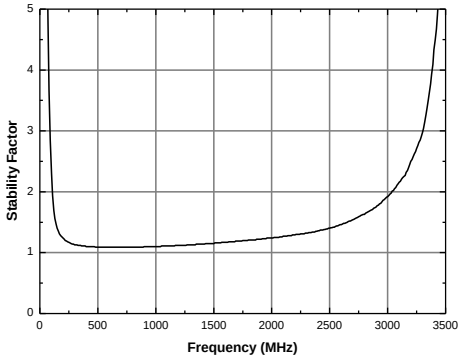


S-parameters & K-factor









APPLICATION CIRCUIT

GSM / CDMA

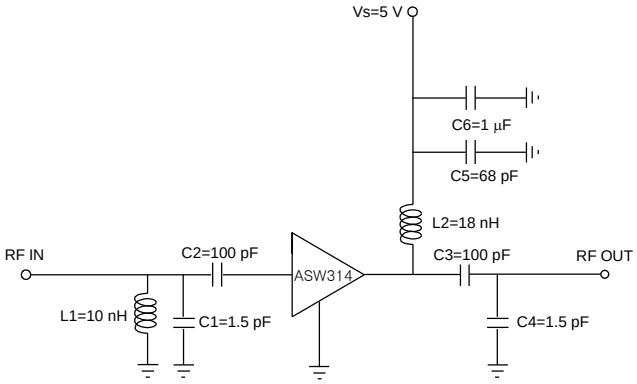
900 MHz

+5 V

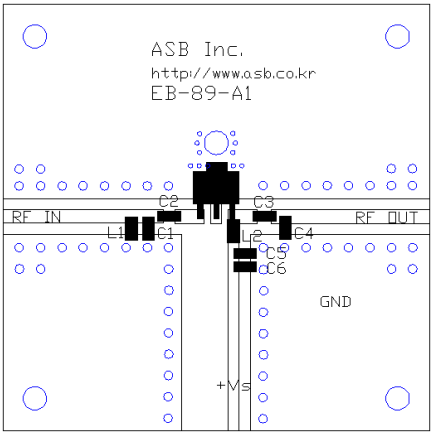
Frequency (MHz)	900
Magnitude S21 (dB)	16.0
Magnitude S11 (dB)	-20
Magnitude S22 (dB)	-15
Output P1dB (dBm)	21
Output IP3[1)] (dBm)	44
Noise Figure (dB)	1.9
Device Voltage (V)	+5
Current (mA)	105

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

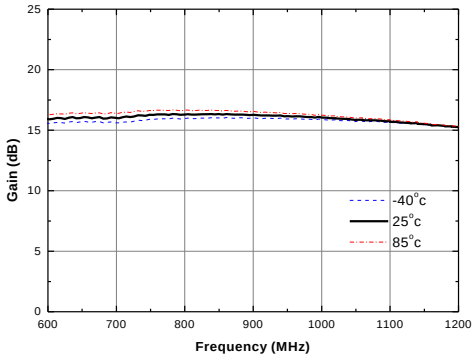
Schematic

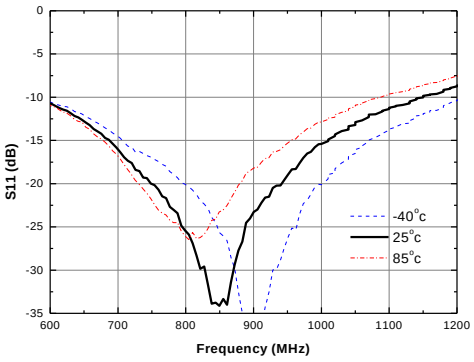


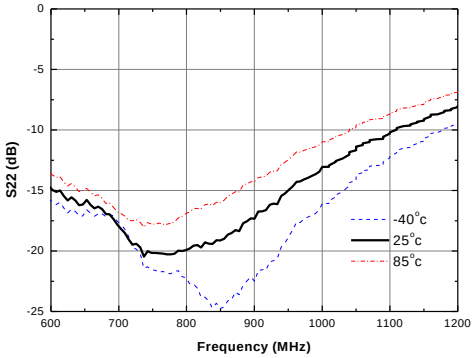
Board Layout (FR4, 40x40 mm², 0.8T)

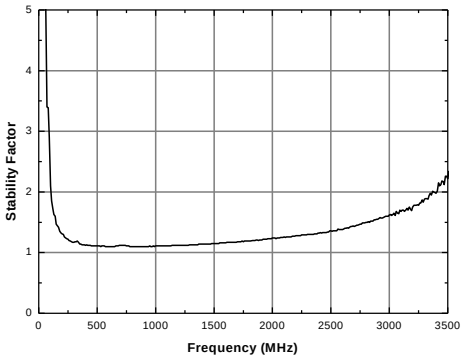


S-parameters & K-factor

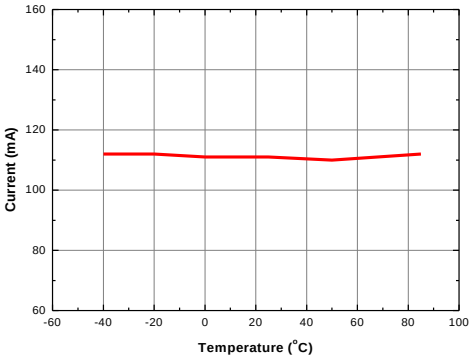




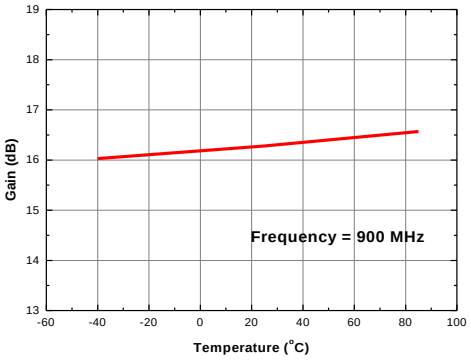




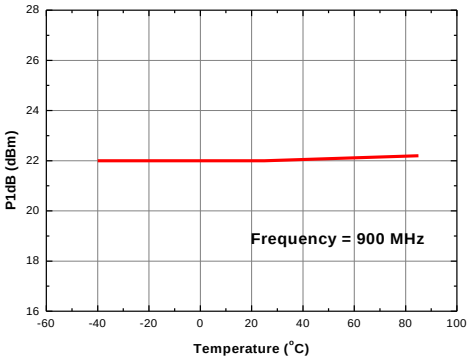
Current vs. Temperature



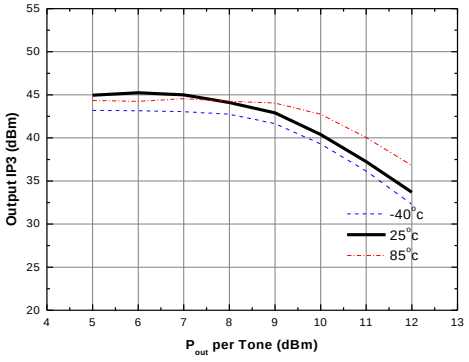
Gain vs. Temperature



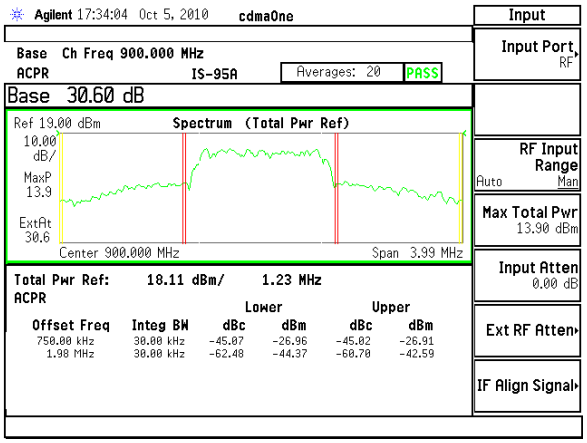
P1dB vs. Temperature

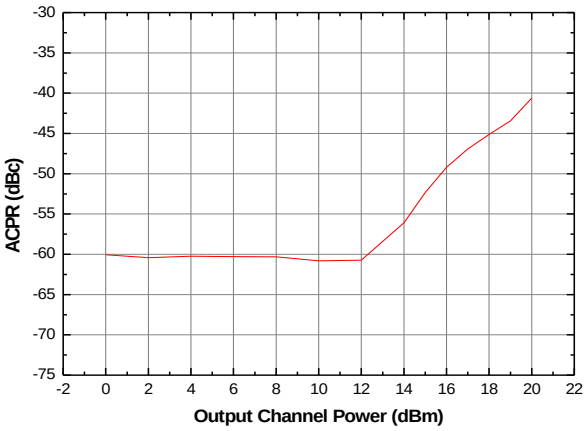


Output IP3 vs. Tone Power (Frequency = 900 MHz)



CDMA ACPR – 1FA





* Test Source : IS-95, 9 ch. Forward 30 kHz Meas BW, 900 MHz / 750 kHz offset

APPLICATION CIRCUIT

LTE

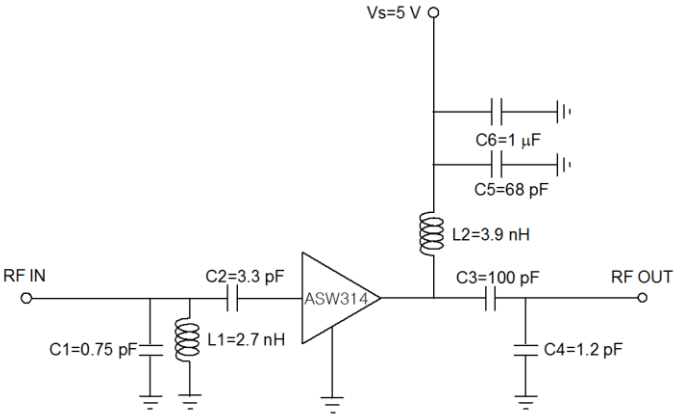
1745 ~ 1860 MHz

+5 V

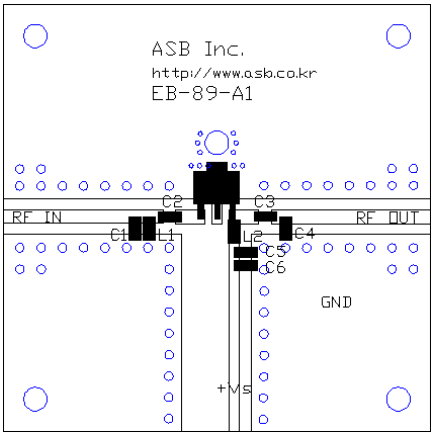
Frequency (MHz)	1745	1860
Magnitude S21 (dB)	14.7	14.7
Magnitude S11 (dB)	-14	-14
Magnitude S22 (dB)	-14	-14
Output P1dB (dBm)	22	22
Output IP3[1)] (dBm)	41	40
Noise Figure (dB)	2.8	2.7
Device Voltage (V)	+5	+5
Current (mA)	105	105

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

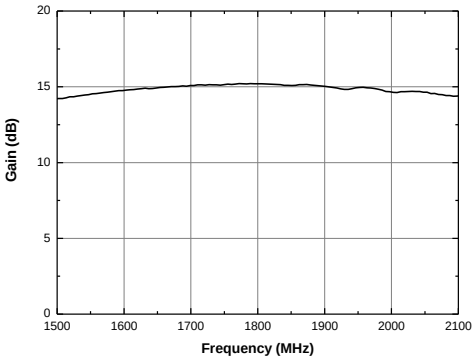
Schematic

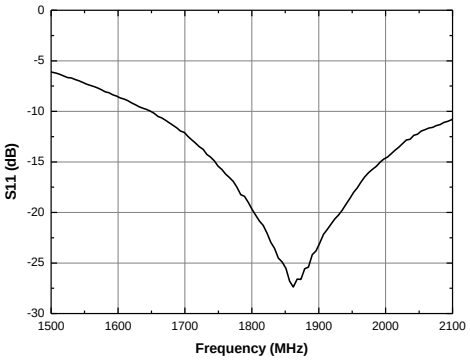


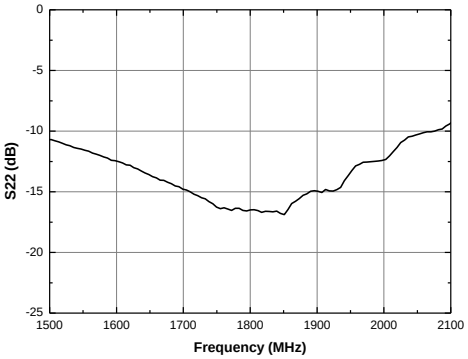
Board Layout (FR4, 40x40 mm², 0.8T)



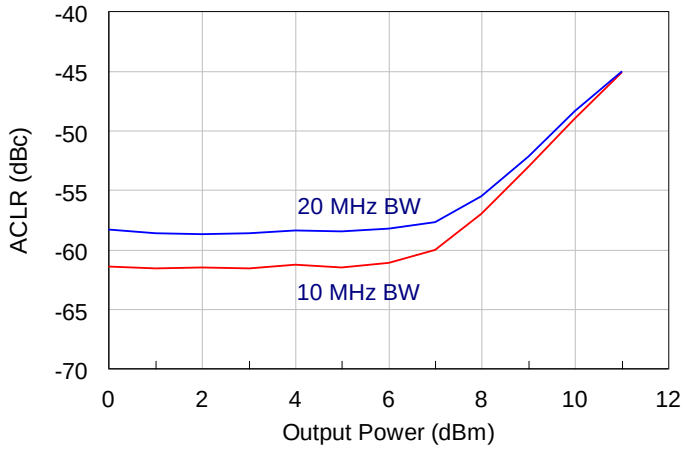
S-parameters & K-factor





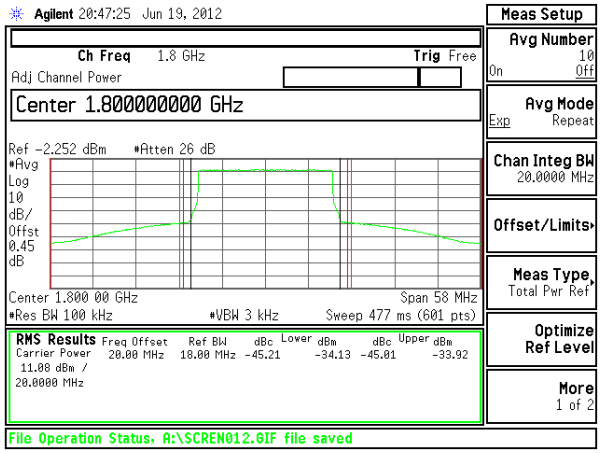


LTE ACLR – 10 MHz & 20 MHz



1) Test Source : LTE_FDD_test model 3.1, BW: 10 MHz & 20 MHz, Test Frequency: 1.8 GHz

LTE ACLR – 20 MHz



2) Test Source : LTE_FDD_test model 3.1, BW: 20 MHz, Test Frequency: 1.8 GHz

APPLICATION CIRCUIT

PCS

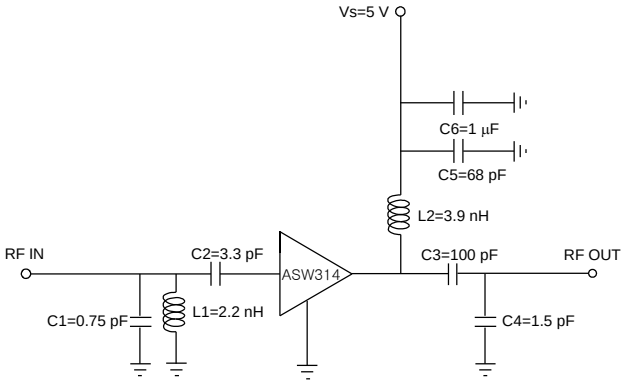
1880 ~ 2025 MHz

+5 V

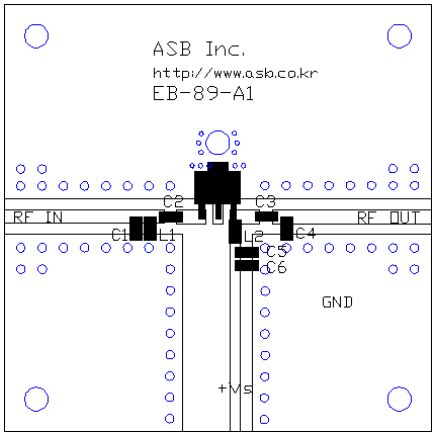
Frequency (MHz)	1880 ~ 2025
Magnitude S21 (dB)	14.0
Magnitude S11 (dB)	-13
Magnitude S22 (dB)	-13
Output P1dB (dBm)	23
Output IP3[1)] (dBm)	42
Noise Figure (dB)	3.0
Device Voltage (V)	+5
Current (mA)	105

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

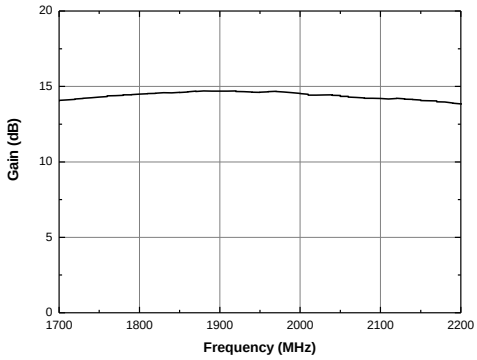
Schematic

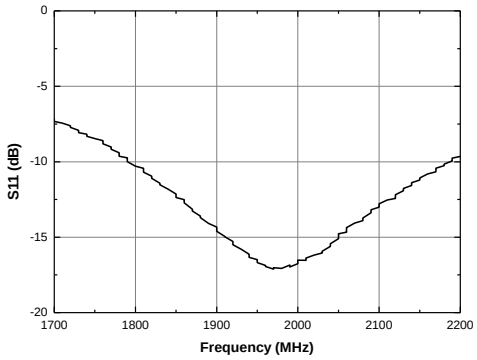


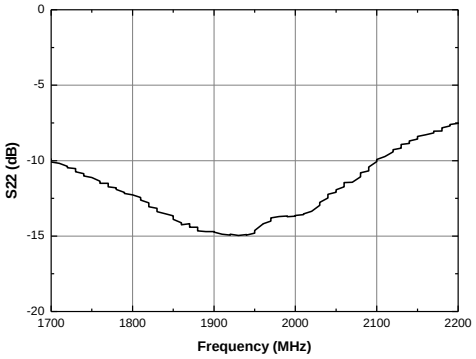
Board Layout (FR4, 40x40 mm², 0.8T)

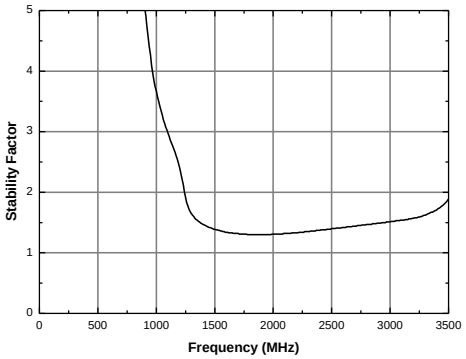


S-parameters & K-factor









APPLICATION CIRCUIT

WCDMA

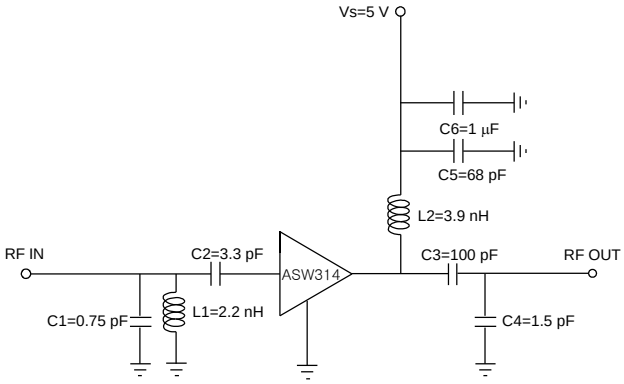
1950 MHz

+5 V

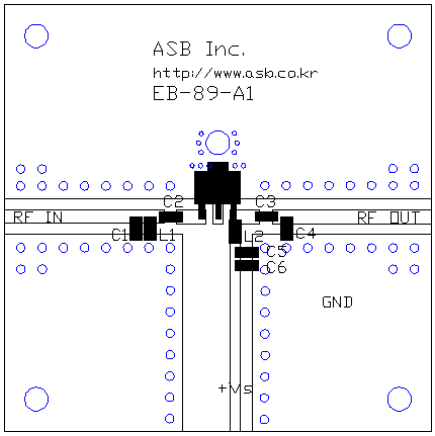
Frequency (MHz)	1950
Magnitude S21 (dB)	14.5
Magnitude S11 (dB)	-13
Magnitude S22 (dB)	-13
Output P1dB (dBm)	23
Output IP3[1)] (dBm)	43
Noise Figure (dB)	3.0
Device Voltage (V)	+5
Current (mA)	105

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

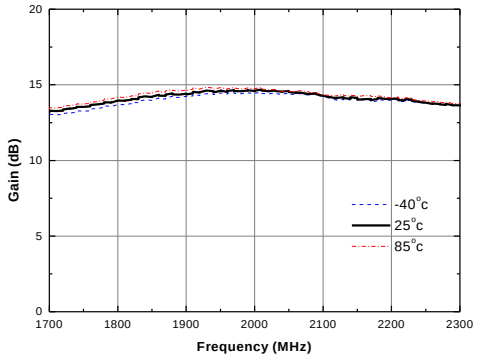
Schematic

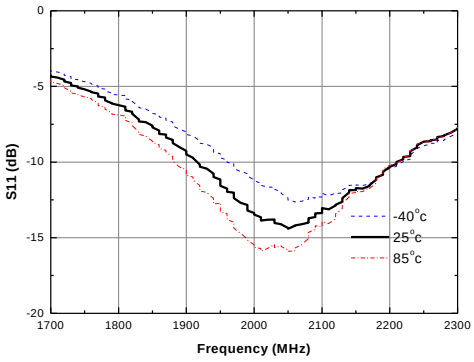


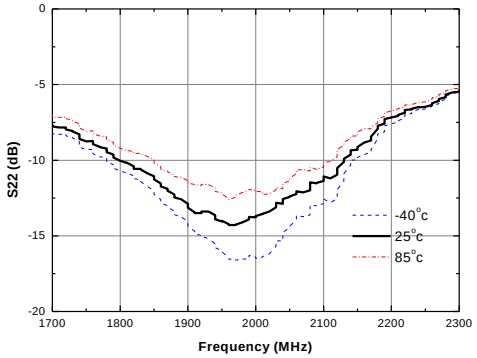
Board Layout (FR4, 40x40 mm², 0.8T)

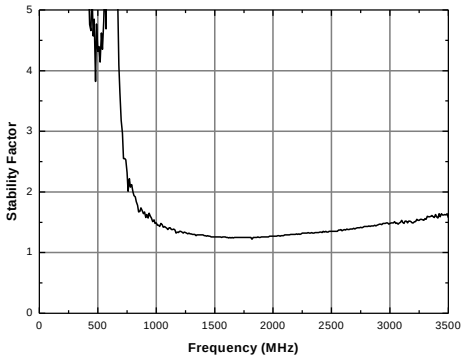


S-parameters & K-factor

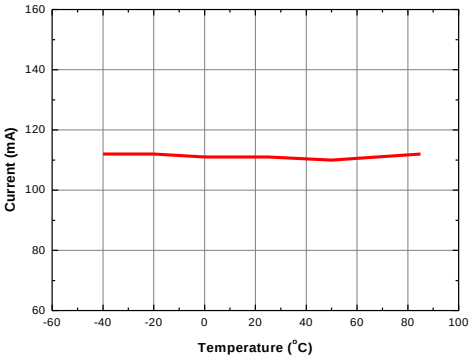




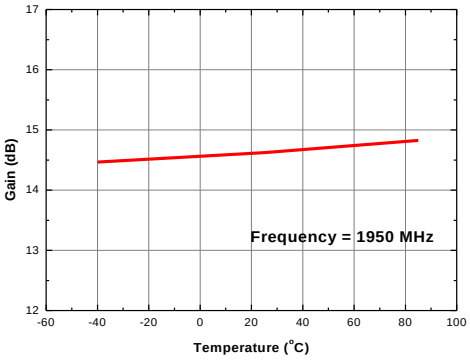




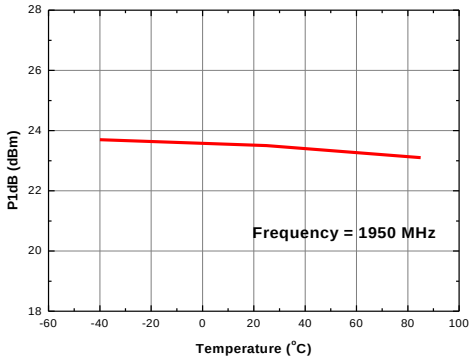
Current vs. Temperature



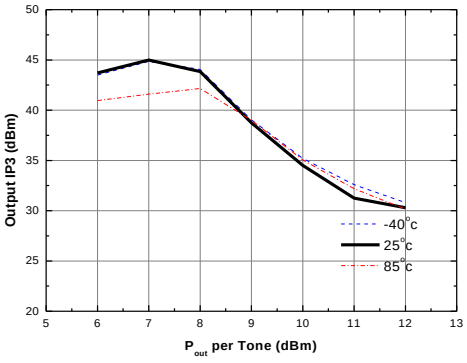
Gain vs. Temperature



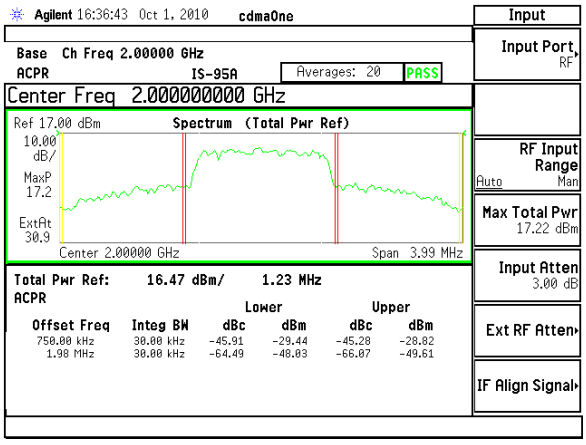
P1dB vs. Temperature

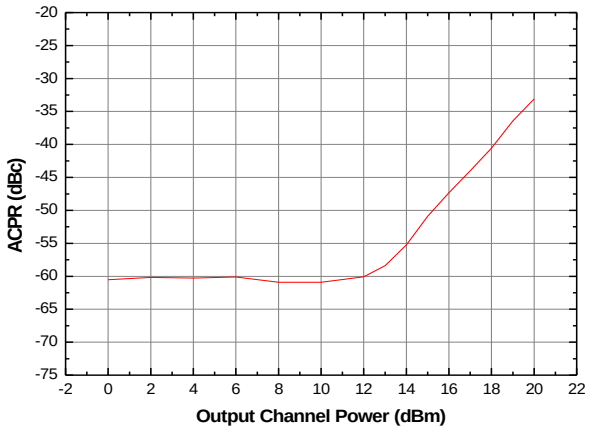


Output IP3 vs. Tone Power (Frequency = 1950 MHz)



WCDMA ACPR – 1FA





* Test Source : IS-95, 9 ch. Forward 30 kHz Meas BW, 2000 MHz / 750 kHz offset

APPLICATION CIRCUIT

WLAN

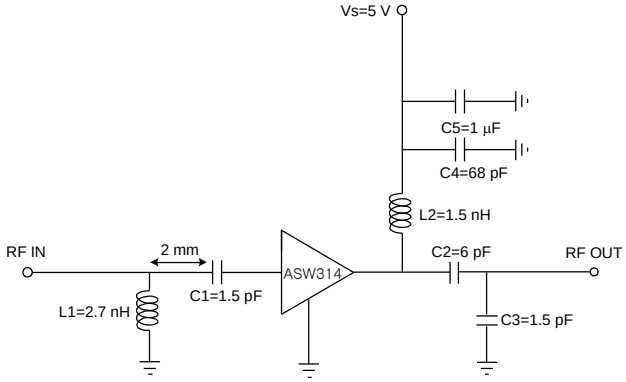
2300 ~ 2400 MHz

+5 V

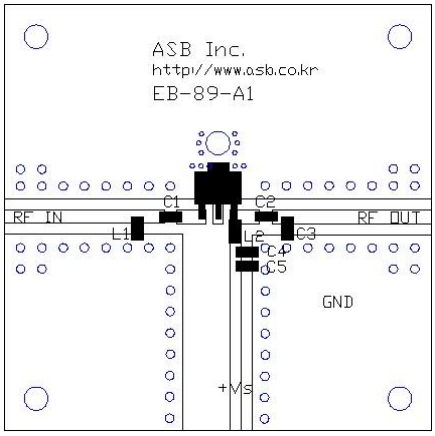
Frequency (MHz)	2300	2400
Magnitude S21 (dB)	14.4	14.5
Magnitude S11 (dB)	-18	-18
Magnitude S22 (dB)	-18	-15
Output P1dB (dBm)	21.5	21.5
Output IP3[1)] (dBm)	41.0	40.5
Noise Figure (dB)	2.6	2.6
Device Voltage (V)	+5	+5
Current (mA)	105	105

1) OIP3 is measured with two tones at an output power of +5 dBm/tone separated by 1 MHz.

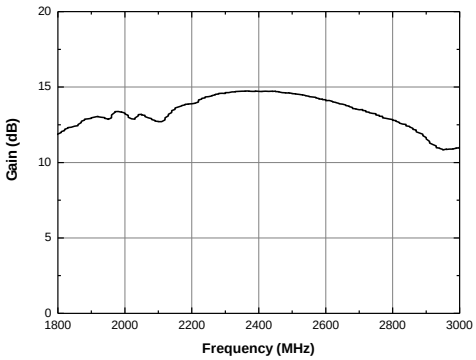
Schematic

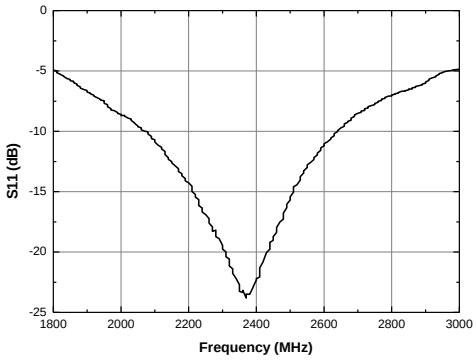


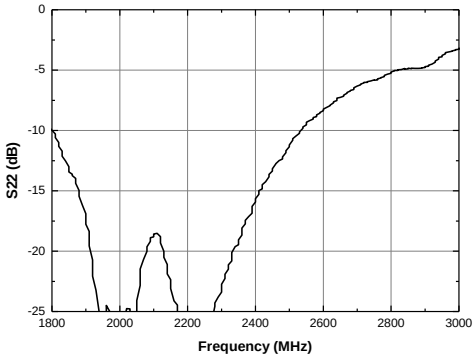
Board Layout (FR4, 40x40 mm², 0.8T)

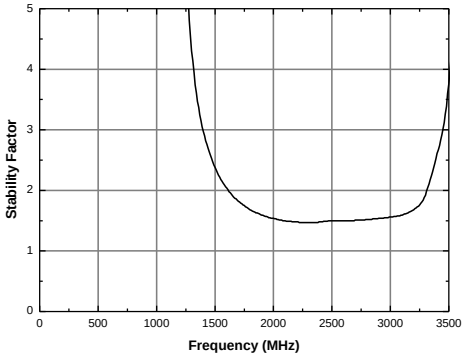


S-parameters & K-factor









APPLICATION CIRCUIT

WLAN

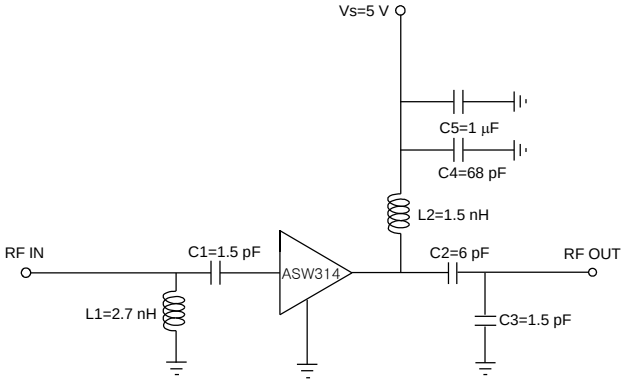
2400 MHz

+5 V

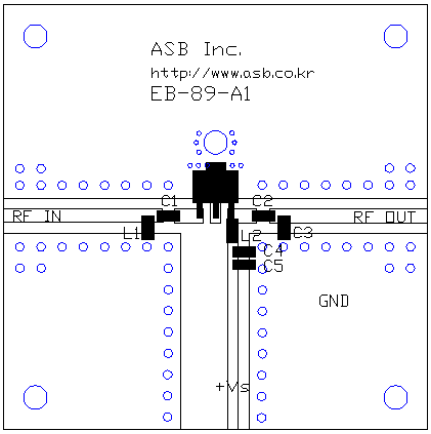
Frequency (MHz)	2400
Magnitude S21 (dB)	14.5
Magnitude S11 (dB)	-15
Magnitude S22 (dB)	-15
Output P1dB (dBm)	21.5
Output IP3[1)] (dBm)	40
Noise Figure (dB)	2.6
Device Voltage (V)	+5
Current (mA)	105

1) OIP3 is measured with two tones at an output power of +5 dBm/tone separated by 1 MHz.

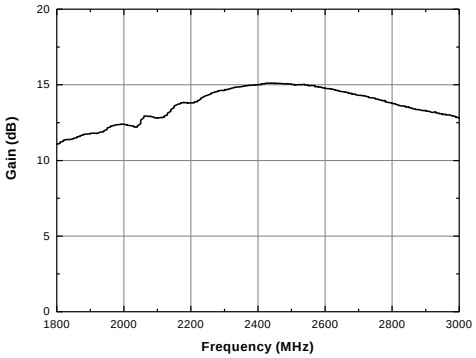
Schematic

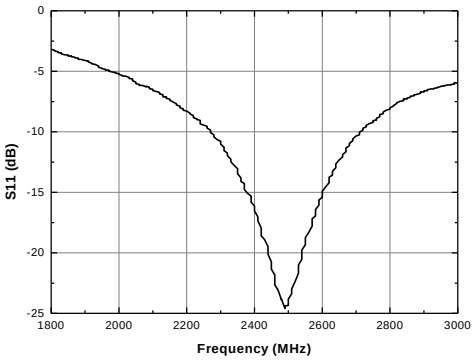


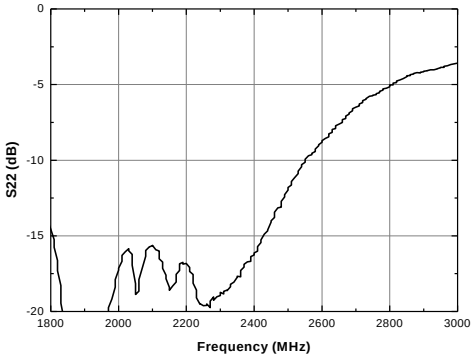
Board Layout (FR4, 40x40 mm², 0.8T)

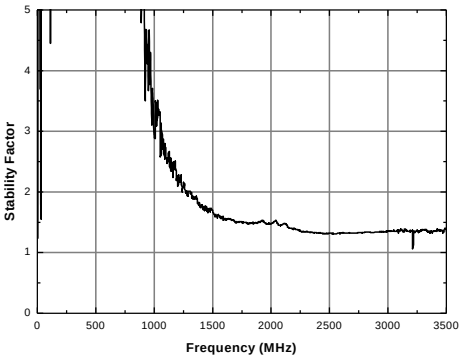


S-parameters & K-factor









APPLICATION CIRCUIT

LTE

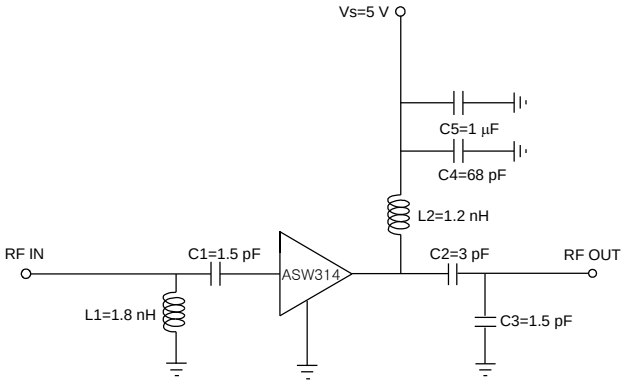
2700 MHz

+5 V

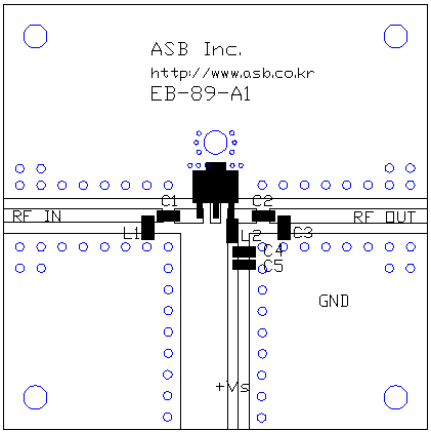
Frequency (MHz)	2700
Magnitude S21 (dB)	14.5
Magnitude S11 (dB)	-18
Magnitude S22 (dB)	-11
Output P1dB (dBm)	20.5
Output IP3[1] (dBm)	38
Noise Figure (dB)	3.1
Device Voltage (V)	+5
Current (mA)	105

1) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1 MHz.

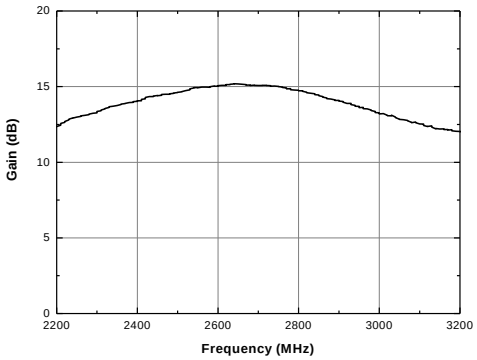
Schematic

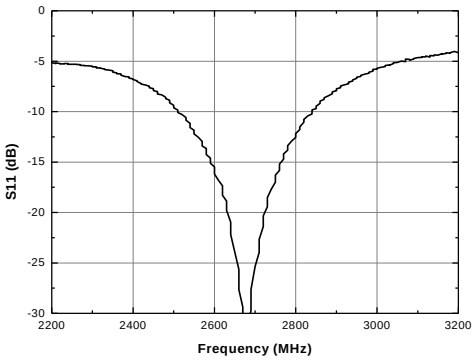


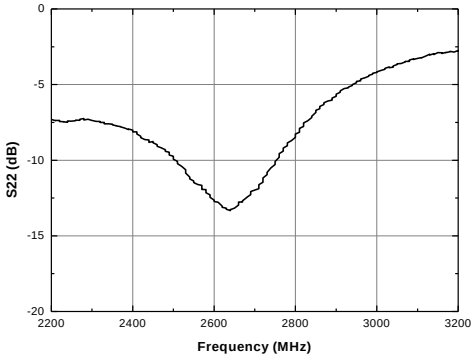
Board Layout (FR4, 40x40 mm², 0.8T)

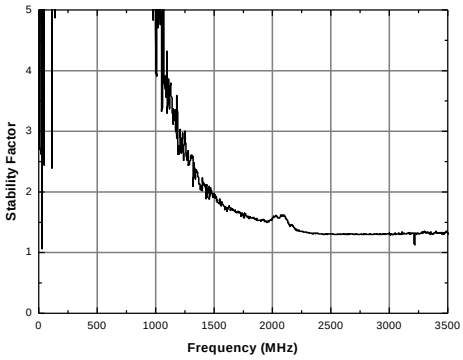


S-parameters & K-factor









APPLICATION CIRCUIT

MoCA

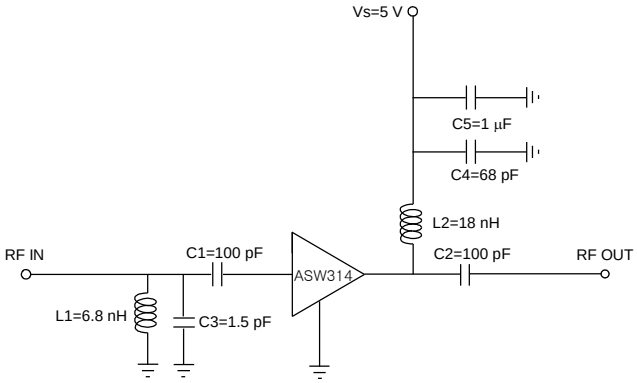
800 ~ 1500 MHz

+5 V, 50 Ω

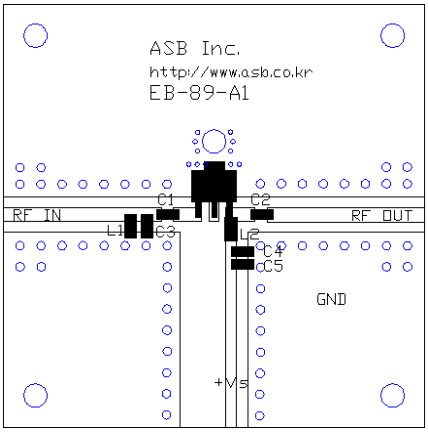
Frequency (MHz)	800	1200	1500
Magnitude S21 (dB)	15.5	15.5	15.1
Magnitude S11 (dB)	-12	-17	-12
Magnitude S22 (dB)	-18	-18	-13
Output P1dB (dBm)	22	22	22
Output IP3[1)] (dBm)	42	43	42
Noise Figure (dB)	2.4	2.0	2.0
Device Voltage (V)	+5	+5	+5
Current (mA)	105	105	105

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

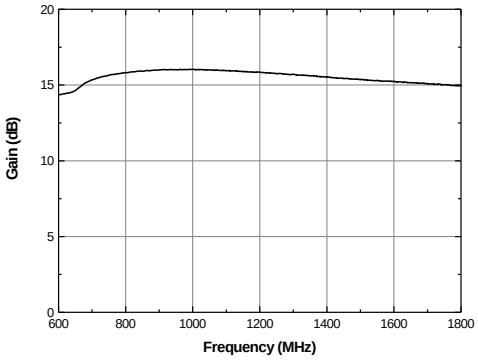
Schematic

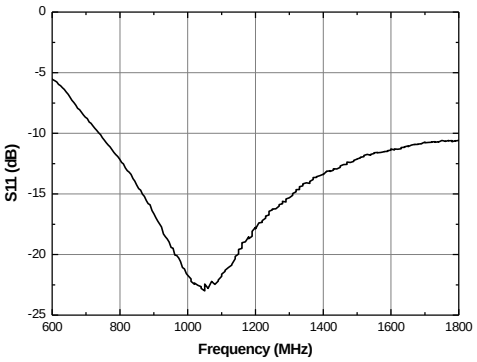


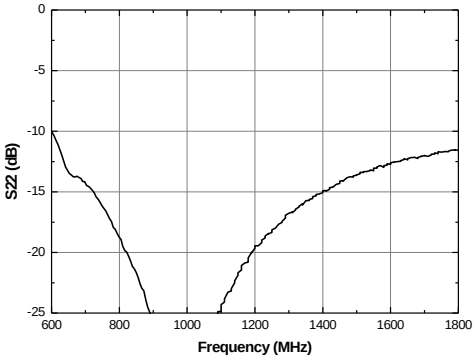
Board Layout (FR4, 40x40 mm², 0.8T)

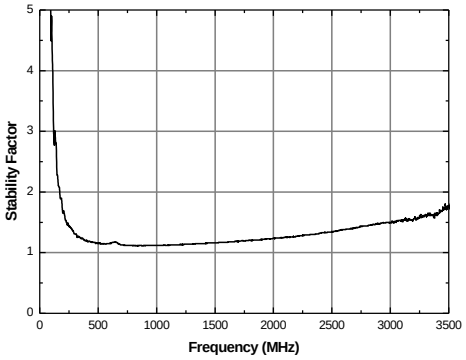


S-parameters & K-factor









APPLICATION CIRCUIT

SMATV

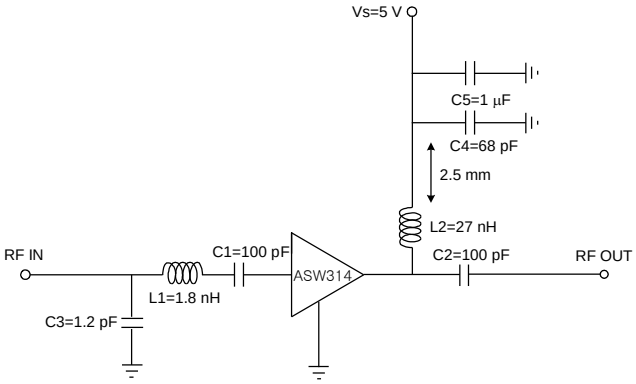
900 ~ 2200 MHz

+5 V, 50 Ω

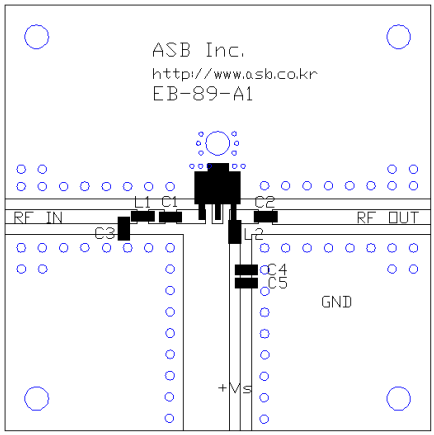
Frequency (MHz)	900	1500	2200
Magnitude S21 (dB)	15.5	15.0	15.0
Magnitude S11 (dB)	-8	-9	-20
Magnitude S22 (dB)	-9	-9	-14
Output P1dB (dBm)	21.5	21.5	18.0
Output IP3[1)] (dBm)	43.0	41.0	38.5
Noise Figure (dB)	1.9	2.0	2.4
Device Voltage (V)	+5	+5	+5
Current (mA)	105	105	105

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

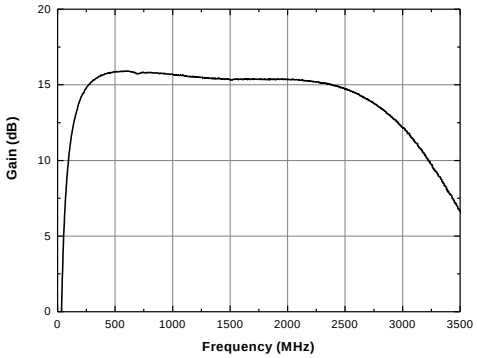
Schematic

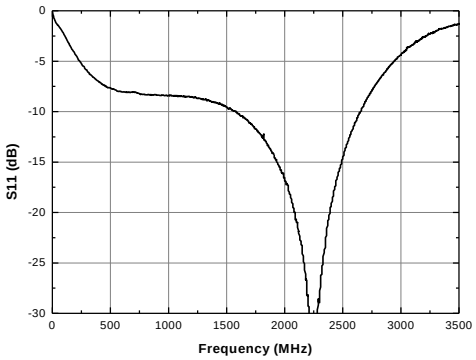


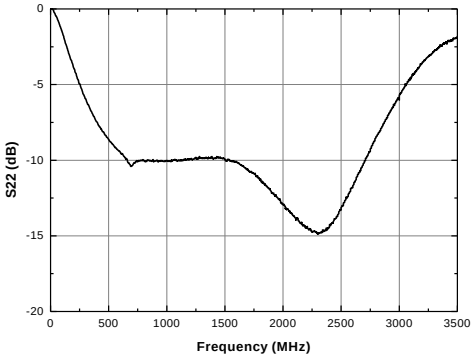
Board Layout (FR4, 40x40 mm², 0.8T)

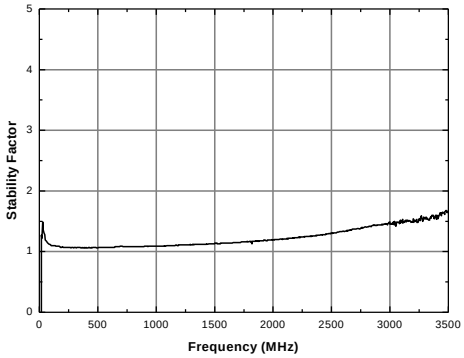


S-parameters & K-factor









APPLICATION CIRCUIT

ONU & Wideband

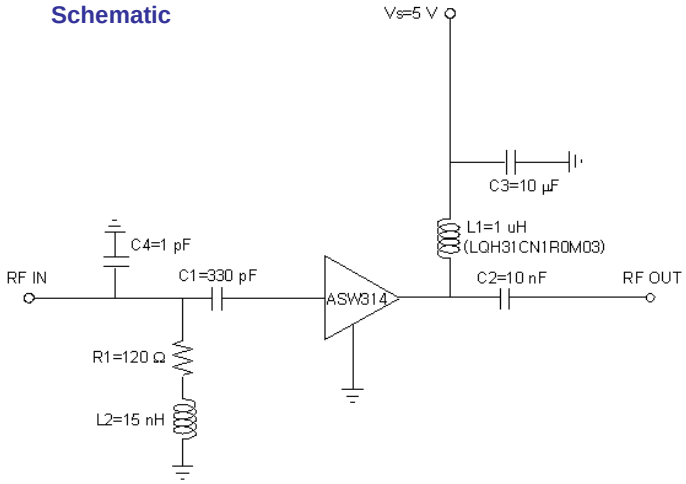
20 ~ 3000 MHz

+5 V

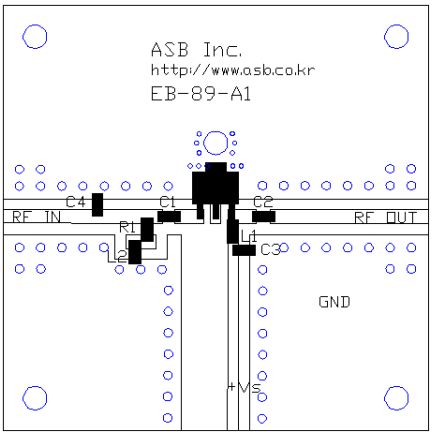
Frequency (MHz)	20	1000	2000	3000
Magnitude S21 (dB)	14.0	14.0	13.5	13.0
Magnitude S11 (dB)	-10.0	-10.0	-7.0	-17.0
Magnitude S22 (dB)	-7.0	-9.0	-6.5	-6.5
Output P1dB (dBm)	21.5	21.5	20.0	18.5
Output IP3 (dBm)[1)]	43.0	41.5	39.5	36.0
Noise Figure (dB)	3.4	3.0	2.5	3.4
Device Voltage (V)	+5	+5	+5	+5
Current (mA)	105	105	105	105

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

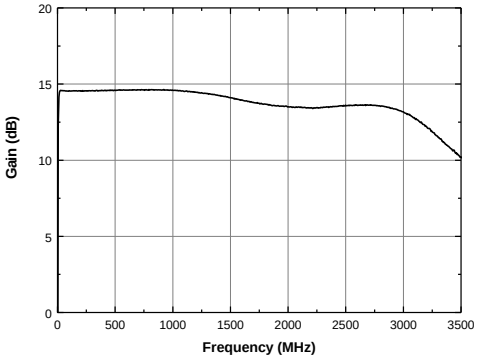
Schematic

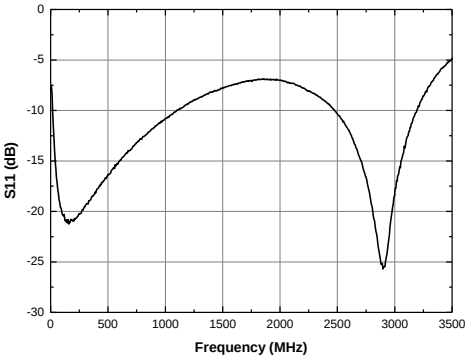


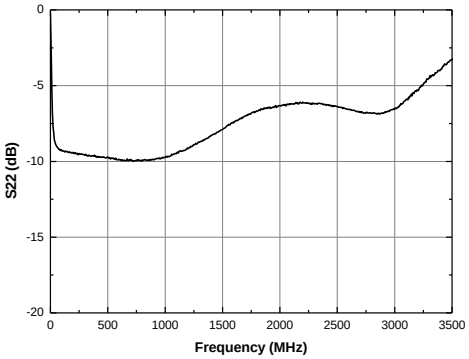
Board Layout (FR4, 40x40 mm², 0.8T)

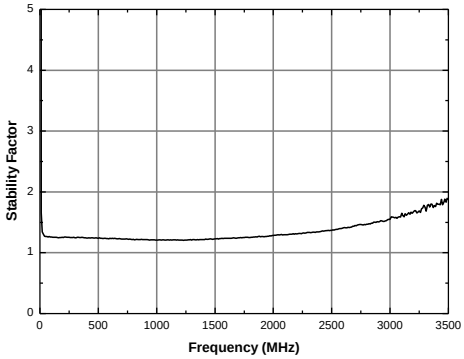


S-parameters & K-factor









APPLICATION CIRCUIT

SMATV & Wideband

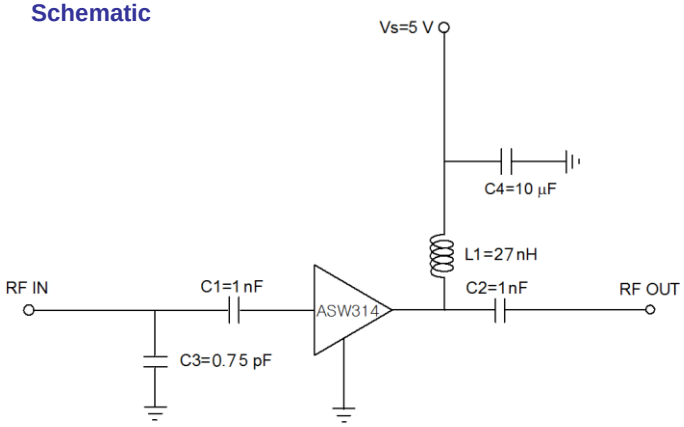
500 ~ 3000 MHz

+5 V

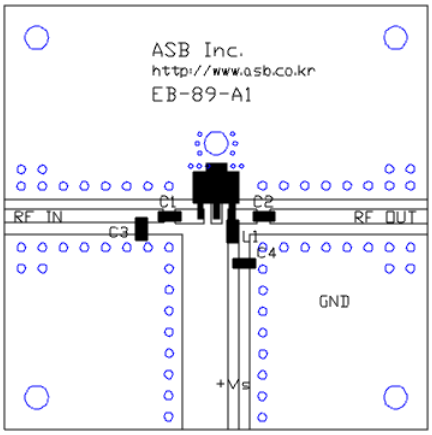
Frequency (MHz)	500	900	2000	3000
Magnitude S21 (dB)	15.0	15.0	13.5	14.0
Magnitude S11 (dB)	-7	-8	-7	-13
Magnitude S22 (dB)	-8	-10	-7	-7
Output P1dB (dBm)	21	21	19	18
Output IP3 (dBm)[1)]	45	45	41	36
Noise Figure (dB)	1.9	2.0	2.3	3.1
Device Voltage (V)	+5	+5	+5	+5
Current (mA)	105	105	105	105

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

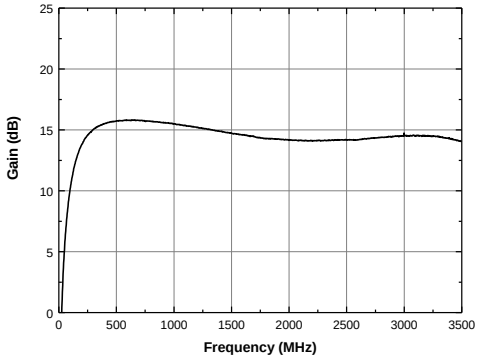
Schematic

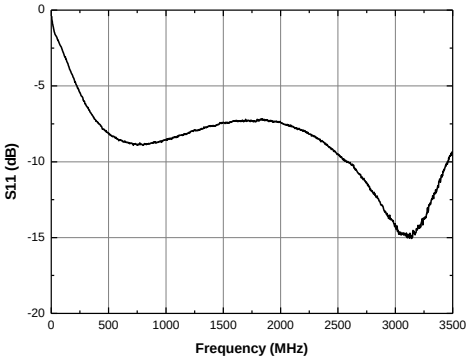


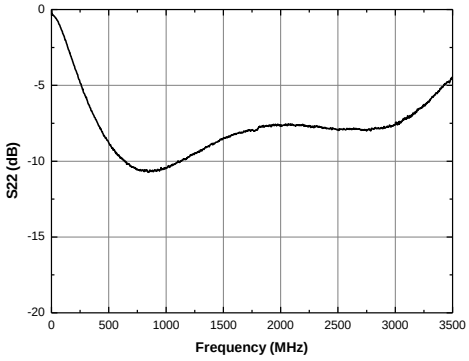
Board Layout (FR4, 40x40 mm², 0.8T)



S-parameters & K-factor







APPLICATION CIRCUIT

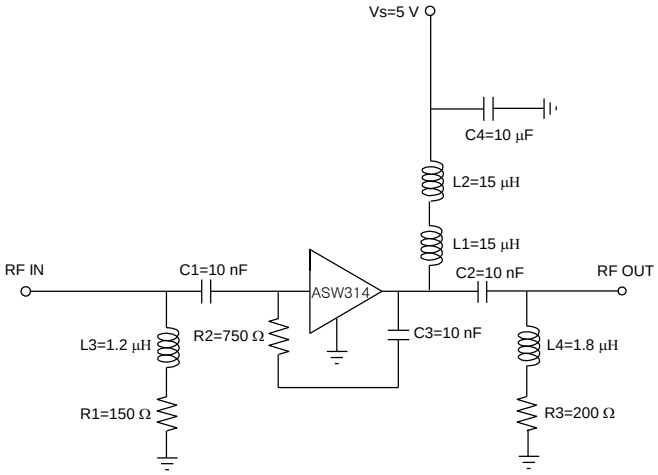
IF
5 ~ 1000 MHz
+5 V

Frequency (MHz)	5	50	1000
Magnitude S21 (dB)	13.7	13.8	12.6
Magnitude S11 (dB)	-13	-20	-13
Magnitude S22 (dB)	-12	-20	-11
Output P1dB (dBm)	20	21	21
Output IP3 (dBm)	40[1)]	40[1)]	39[2)]
Noise Figure (dB)	2.9	2.2	2.7
Device Voltage (V)	+5	+5	+5
Current (mA)	105	105	105

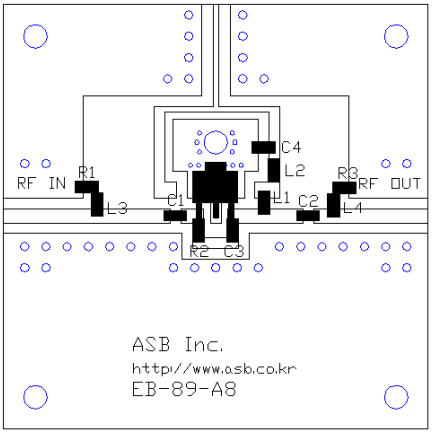
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

2) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.

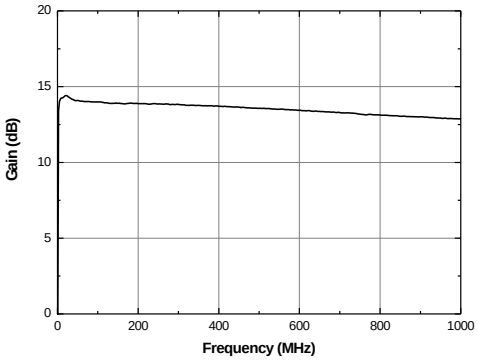
Schematic

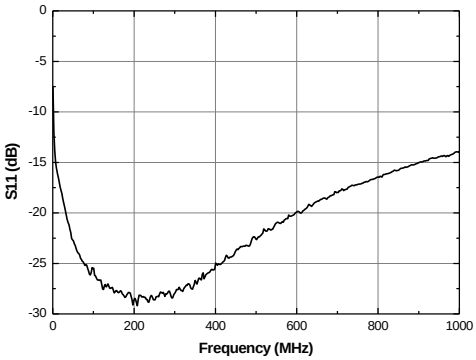


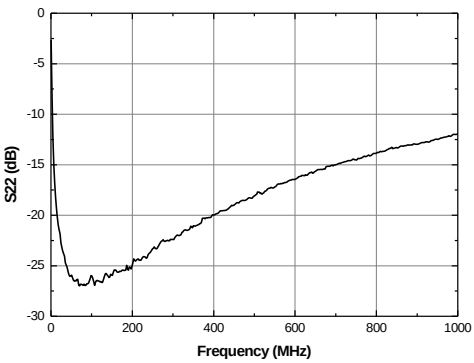
Board Layout (FR4, 40x40 mm², 0.8T)

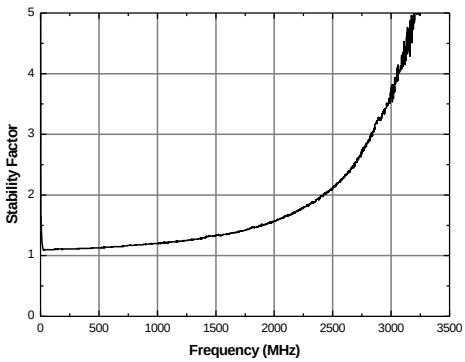


S-parameters & K-factor









Performance with varying V_{DEVICE}

V_{DEVICE} (V)	Current (mA)	Freq. (MHz)	Gain (dB)	S11 (dB)	S22 (dB)	OIP3 (dBm)	P1dB (dBm)	NF (dB)
5.0	105	150	16.4	-13.7	-13.8	40.0	22.8	1.65
		900	16.2	-22.7	-15.4	45.6	21.6	1.86
		1950	14.6	-17.8	-11.5	44.5	23.7	2.92
4.6	95	150	16.4	-14.1	-14.1	42.7	21.7	1.62
		900	16.1	-23.0	-15.9	43.5	21.4	1.76
		1950	14.6	-15.6	-13.3	41.7	23.0	2.85
4.3	85	150	16.4	-14.1	-14.2	42.5	21.5	1.64
		900	16.0	-23.0	-15.7	41.2	20.0	1.73
		1950	14.6	-15.8	-13.0	38.0	21.6	2.83
3.95	75	150	16.3	-13.9	-14.1	42.7	20.6	1.64
		900	15.9	-22.5	-15.6	38.3	19.1	1.72
		1950	14.5	-15.8	-12.6	35.6	20.6	2.80

Recommended Soldering Reflow Profile